Argonne NATIONAL LABORATORY

Discovering Process-Variable-to-Signal Relationships

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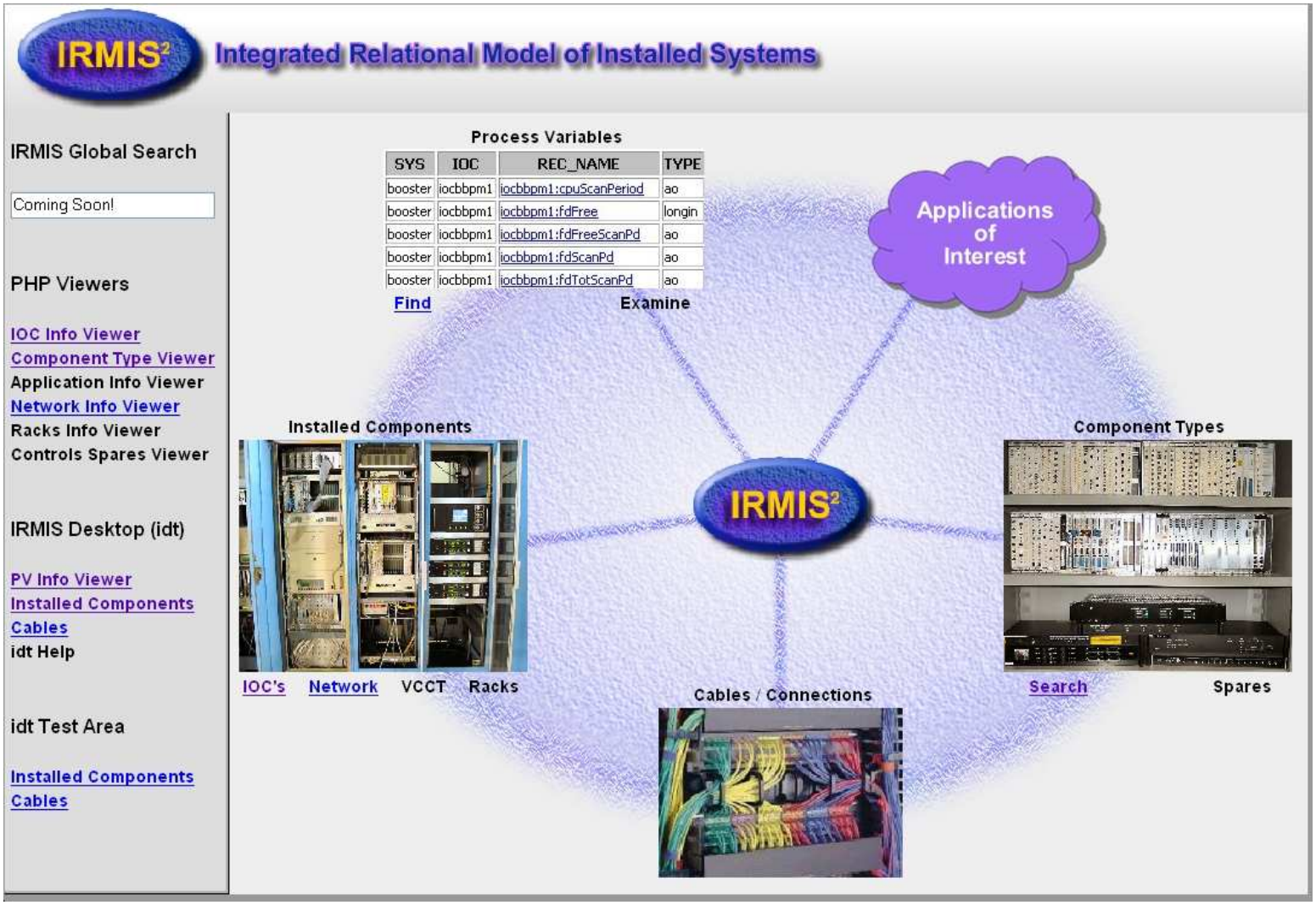
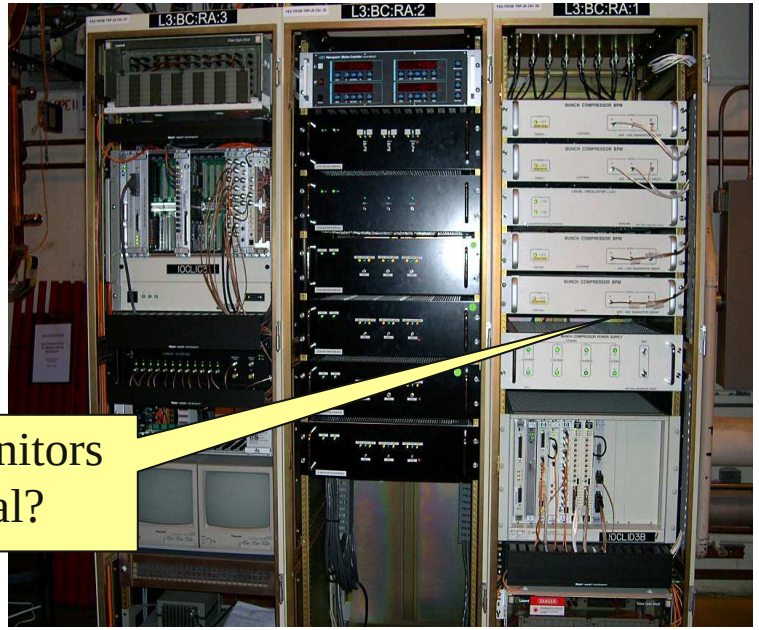
IRMIS Relationships



One Relationship still escapes us … PV-to-Signal

Which field signal does this Process Variable control?

For ongoing operation and maintenance of a large accelerator facility, it is imperative to know the relationship between Process Variables and field signals. This relationship should be traceable in either direction.



Which PV(s) monitors this field signal?

Attempts to document this relationship exist, but they are either intensely manual or non-exhaustive (or both).

Selection Criteria

System	IOC	Link	Rack	Pslot	Card Type	Config	Comments
linac	ioclid2	0	1	0	1771-IFE	D	

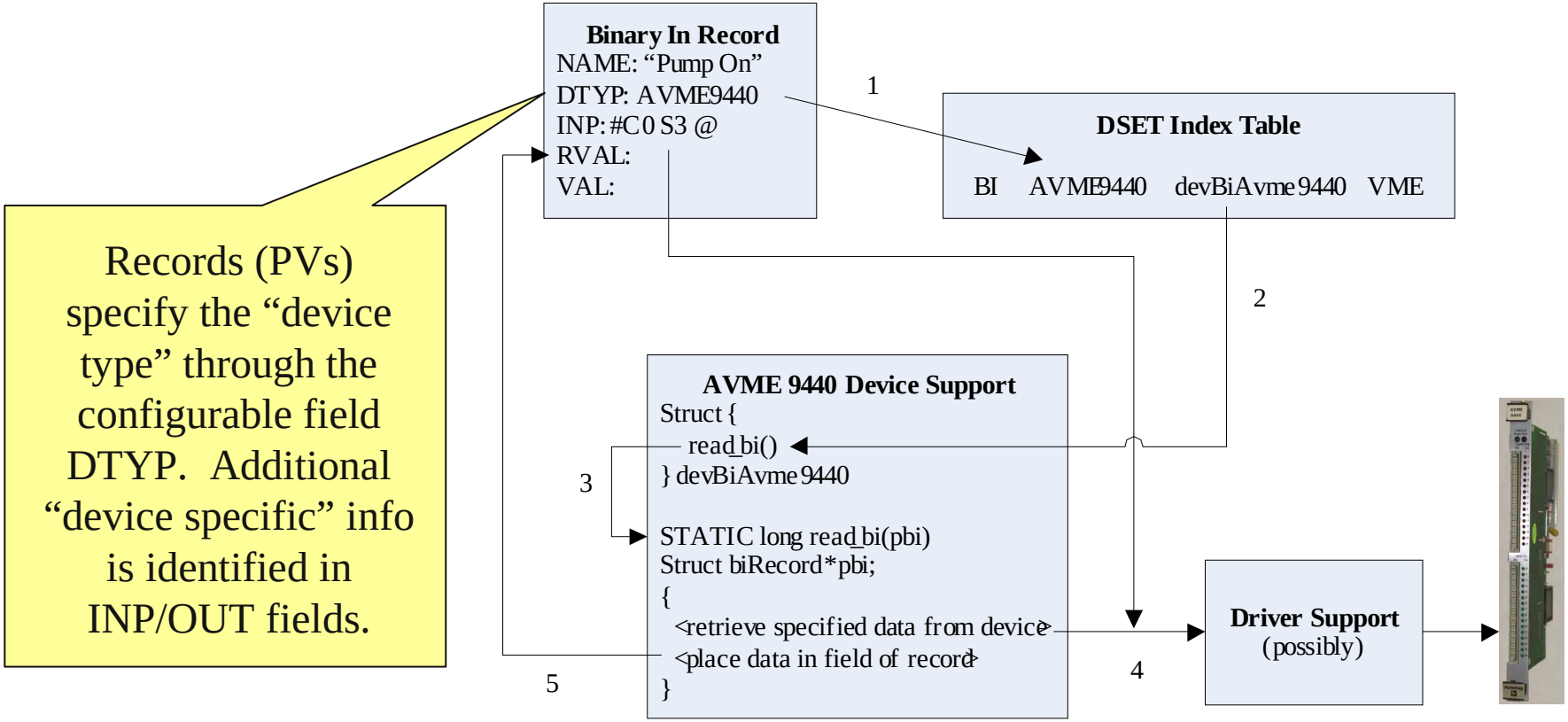
Chassis Information

Name	Address Mode	Location
AB:Low Level RF #2	2 slot	Rack B2

Terminal Information

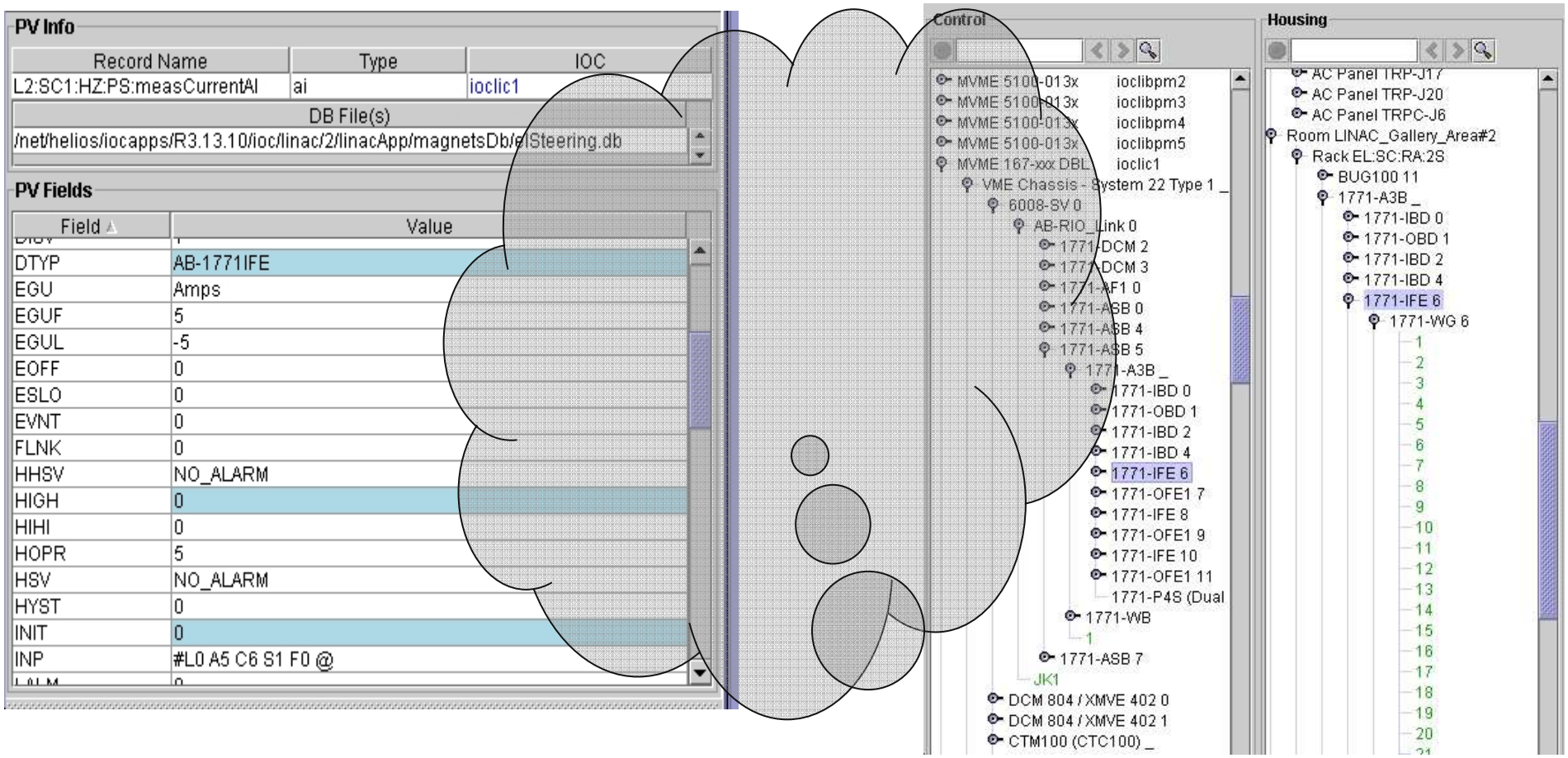
Terminal	Input/Output	Signal Name	Field Connection	Wire ID	Comments	Signal	PV
1	Input 0 (Ch 1) +	L2:MA:klyPos +	Attenuator Control Panel : U2-5	B2-02-RED		0	L2:MA:klyPosAI L2:IOCLID2:AB0:A1:statMI
2	Input 0 (Ch 1) -	L2:MA:klyPos -	Attenuator Control Panel : U2-6	B2-02-BLK			
3	Input 1 (Ch 2) +	L2:MA:loDrvPos +	Attenuator Control Panel : U2-7	B2-03-RED		1	L2:MA:loDrvPosAI
4	Input 1 (Ch 2) -	L2:MA:loDrvPos -	Attenuator Control Panel : U2-8	B2-03-BLK			
5							
6	Input 2 (Ch 3) +	L2:LL:psP24V +	Attenuator Control Panel : U3-1	B2-01-PR1-RED		2	L2:LL:psP24VAI
7	Input 2 (Ch 3) -	L2:LL:psP24V -	Attenuator Control Panel : U3-2	B2-01-PR1-BLK			
8	Input 3 (Ch 4) +	L2:LL:psN15V +	Attenuator Control Panel : U3-5	B2-01-PR2-RED		3	L2:LL:psN15VAI
9	Input 3 (Ch 4) -	L2:LL:psN15V -	Attenuator Control Panel : U3-6	B2-01-PR2-BLK			
10							

Can this relationship be "discovered" in EPICS?

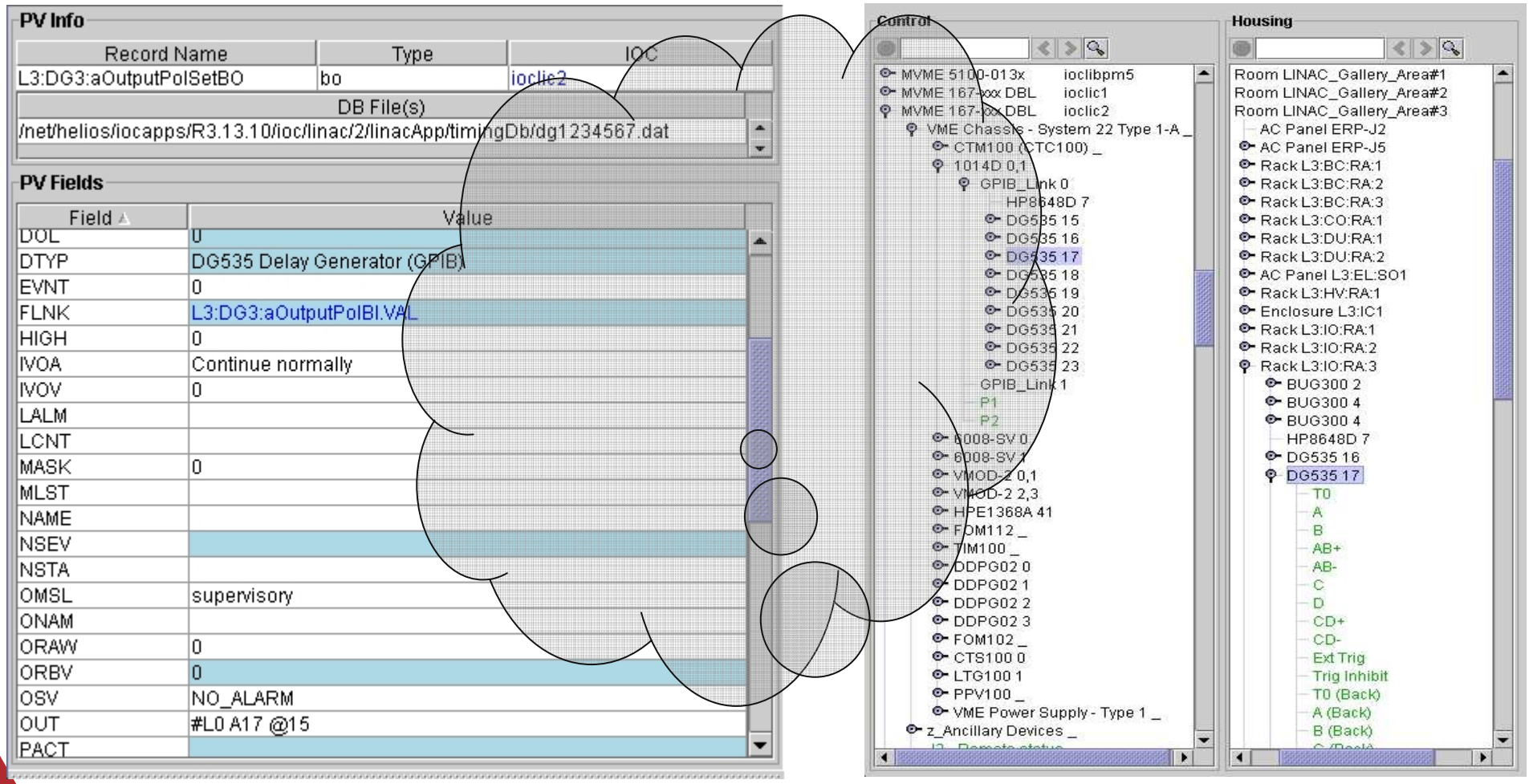


Although certain specifics about the field signal location can be heuristically determined, *there are no hard rules for mapping between INP/OUT and an actual device port. Due to the diverse styles of device support authorship, the PV-to-signal relationship cannot be traced with existing EPICS facilities.*

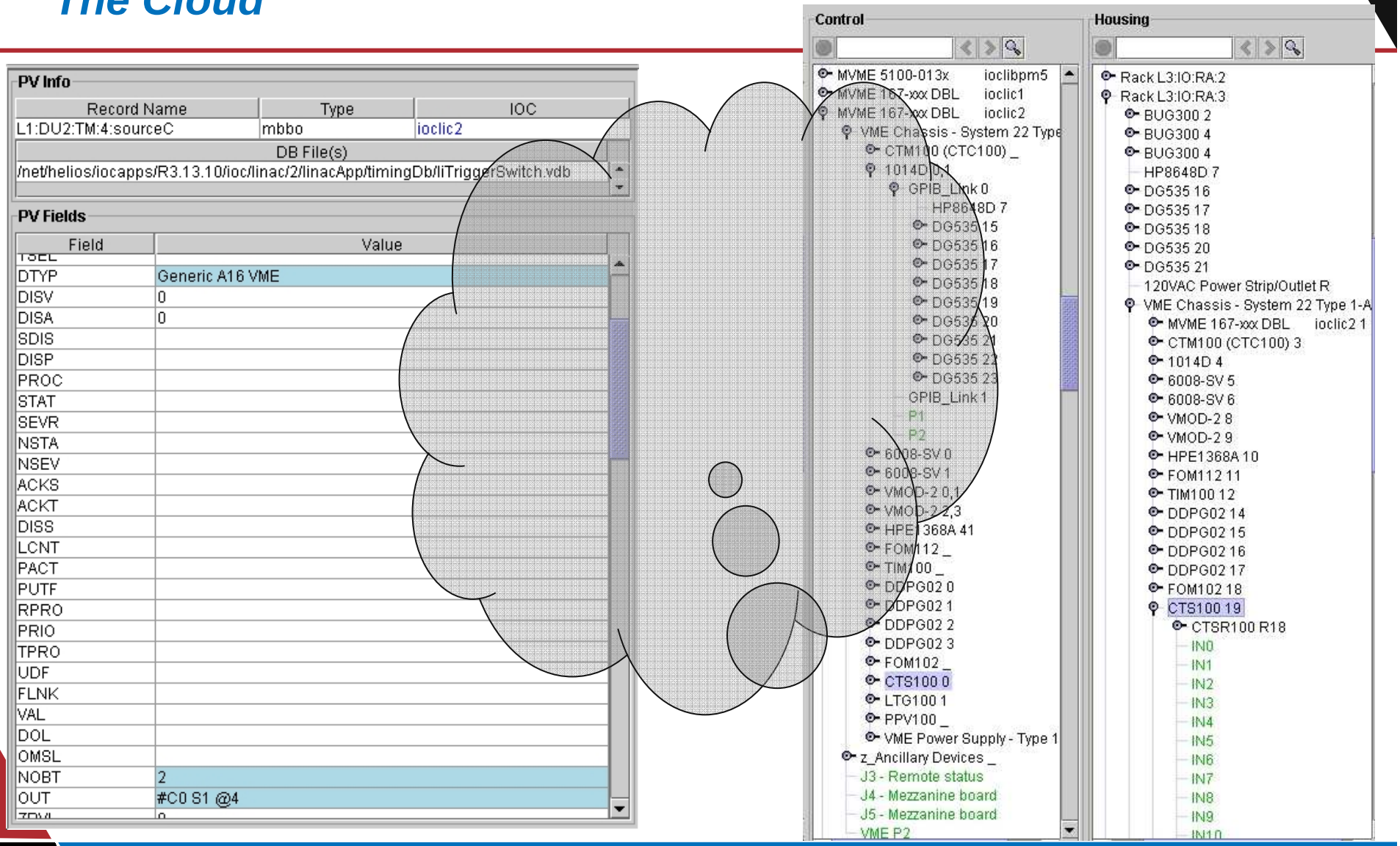
The Cloud


PV Info
Record Name
Type
IOC
L2:SC1:HZ:PS:measCurrentAI
ai
ioclic1
DB File(s)
/net/helios/iocapps/R3.13.10/ioc/linac/2/linacApp/magnetsDb/elSteering.db
PV Fields
Field
Value
DTYP
AB-1771IFE
EGU
Amps
EGUF
5
EGUL
-5
EOFF
0
ESLO
0
EVNT
0
FLNK
0
HHSV
NO_ALARM
HIGH
0
HIHI
0
HOPR
5
HSV
NO_ALARM
HYST
0
INIT
0
INP
#L0 A5 C6 S1 F0 @
Control
MVME 5100-013x ioclibpm2
MVME 5100-013x ioclibpm3
MVME 5100-013x ioclibpm4
MVME 5100-013x ioclibpm5
MVME 167-xxx DBL ioclic1
VME Chassis - System 22 Type 1 _
6008-SV 0
AB-RIO_Link 0
1771-DCM 2
1771-DCM 3
1771-AF1 0
1771-ASB 0
1771-ASB 4
1771-ASB 5
1771-A3B _
1771-IBD 0
1771-OBD 1
1771-IBD 2
1771-IBD 4
1771-IFE 6
1771-OFE1 7
1771-IFE 8
1771-OFE1 9
1771-IFE 10
1771-OFE1 11
1771-P4S (Dual
1771-WB
1
1771-ASB 7
JK1
DCM 804 / XMVE 402 0
DCM 804 / XMVE 402 1
CTM100 (CTC100) _
Housing
AC Panel TRP-J17
AC Panel TRP-J20
AC Panel TRPC-J6
Room LINAC_Gallery_Area#2
Rack EL:SC:RA:2S
BUG100 11
1771-A3B _
1771-IBD 0
1771-OBD 1
1771-IBD 2
1771-IBD 4
1771-IFE 6
1771-WG 6
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

The Cloud


PV Info
Record Name
Type
IOC
L3:DG3:aOutputPolSetBO
bo
ioclic2
DB File(s)
/net/helios/iocapps/R3.13.10/ioc/linac/2/linacApp/timingDb/dg1234567.dat
PV Fields
Field
Value
DOL
0
DTYP
DG535 Delay Generator (GPIB)
EVNT
0
FLNK
L3:DG3:aOutputPolBI.VAL
HIGH
0
IVOA
Continue normally
IVOV
0
LALM
LCNT
MASK
0
MLST
NAME
NSEV
NSTA
OMSL
supervisory
ONAM
ORAW
0
ORBV
0
OSV
NO_ALARM
OUT
#L0 A17 @15
PACT
Control
MVME 5100-013x ioclibpm5
MVME 167-xxx DBL ioclic1
MVME 167-xxx DBL ioclic2
VME Chassis - System 22 Type 1-A _
CTM100 (CTC100) _
1014D 0,1
GPIB_Link 0
HP8648D 7
DG535 15
DG535 16
DG535 17
DG535 18
DG535 19
DG535 20
DG535 21
DG535 22
DG535 23
GPIB_Link 1
P1
P2
6008-SV 0
6008-SV 1
VMOD-2 0,1
VMOD-2 2,3
HPE1368A 41
FOM112 _
TIM100 _
DDPG02 0
DDPG02 1
DDPG02 2
DDPG02 3
FOM102 _
CTS100 0
LTG100 1
PPV100 _
VME Power Supply - Type 1 _
z_Ancillary Devices _
Housing
Room LINAC_Gallery_Area#1
Room LINAC_Gallery_Area#2
Room LINAC_Gallery_Area#3
AC Panel ERP-J2
AC Panel ERP-J5
Rack L3:BC:RA:1
Rack L3:BC:RA:2
Rack L3:BC:RA:3
Rack L3:CO:RA:1
Rack L3:DU:RA:1
Rack L3:DU:RA:2
AC Panel L3:EL:SO1
Rack L3:HV:RA:1
Enclosure L3:IC1
Rack L3:IO:RA:1
Rack L3:IO:RA:2
Rack L3:IO:RA:3
BUG300 2
BUG300 4
BUG300 4
HP8648D 7
DG535 16
DG535 17
T0
A
B
AB+
AB-
C
D
CD+
CD-
Ext Trig
Trig Inhibit
T0 (Back)
A (Back)
B (Back)

The Cloud


PV Info
Record Name
Type
IOC
L1:DU2:TM:4:sourceC
mbbo
ioclic2
DB File(s)
/net/helios/iocapps/R3.13.10/ioc/linac/2/linacApp/timingDb/liTriggerSwitch.vdb
PV Fields
Field
Value
DTYP
Generic A16 VME
DISV
0
DISA
0
SDIS
DISP
PROC
STAT
SEVR
NSTA
NSEV
ACKS
ACKT
DISS
LCNT
PACT
PUTF
RPRO
PRIO
TPRO
UDF
FLNK
VAL
DOL
OMSL
NOBT
2
OUT
#C0 S1 @4
Control
MVME 5100-013x ioclibpm5
MVME 167-xxx DBL ioclic1
MVME 167-xxx DBL ioclic2
VME Chassis - System 22 Type
CTM100 (CTC100) _
1014D 0,1
GPIB_Link 0
HP8648D 7
DG535 15
DG535 16
DG535 17
DG535 18
DG535 19
DG535 20
DG535 21
DG535 22
DG535 23
GPIB_Link 1
P1
P2
6008-SV 0
6008-SV 1
VMOD-2 0,1
VMOD-2 2,3
HPE1368A 41
FOM112 _
TIM100 _
DDPG02 0
DDPG02 1
DDPG02 2
DDPG02 3
FOM102 _
CTS100 0
LTG100 1
PPV100 _
VME Power Supply - Type 1
z_Ancillary Devices _
J3 - Remote status
J4 - Mezzanine board
J5 - Mezzanine board
VME P2
Housing
Rack L3:IO:RA:2
Rack L3:IO:RA:3
BUG300 2
BUG300 4
BUG300 4
HP8648D 7
DG535 16
DG535 17
DG535 18
DG535 20
DG535 21
120VAC Power Strip/Outlet R
VME Chassis - System 22 Type 1-A
MVME 167-xxx DBL ioclic2 1
CTM100 (CTC100) 3
1014D 4
6008-SV 5
6008-SV 6
VMOD-2 8
VMOD-2 9
HPE1368A 10
FOM112 11
TIM100 12
DDPG02 14
DDPG02 15
DDPG02 16
DDPG02 17
FOM102 18
CTS100 19
CTSR100 R18
IN0
IN1
IN2
IN3
IN4
IN5
IN6
IN7
IN8
IN9
IN10

Dispersing the Cloud

- The *missing link* to allow fully automatic discovery of the relationship between a Process Variable and a field signal occurs at the device support layer (unique code for each device type).
- If an additional lookup table (link_rule table) were available that identified the relationship between the INP/OUT specifiers and the device port (or parameter), the relationship could be “mined” by an intelligent “crawler” script. Such a table would look similar to the one below:

DSET Routine Name	Expected INP/OUT Structure	Port Identifier Token	Device Port (Connector)	Device Signal Name
devBiAvme9440	#C_ S_ @< string>	S0	P1	INP00
devBiAvme9440	#C_ S_ @< string>	S1	P1	INP01
devBiAvme9440	#C_ S_ @< string>	S2	P1	INP02
devBiAvme9440	#C_ S_ @< string>	S3	P1	INP02
devAiDg535	#L_ A_ @	@2	A_Out	A_Out
devAiDg535	#L_ A_ @	@3	B_Out	B_Out
devAiDg535	#L_ A_ @	@4	C_Out	C_Out
devAiDg535	#L_ A_ @	@5	D_Out	D_Out

Exhaustive??

- Such a table would disperse the cloud for only a portion of component types. What about:
  - Multiple modules using the same device support
  - Dynamic I/O fields, such as scalc records or “gpib” records
  - Data fetched from PLCs (the ladder logic is *another* cloud!)
  - Serial devices for which the ports are configured in st.cmd

```
# configure serial port(s)
initOctalUART("octalUart0","ipMV162","IP_c",8,0x68)
initOctalUARTPort("UART-0-0","octalUart0",0, 9600,"N",1,8,"N")
initOctalUARTPort("UART-0-1","octalUart0",1, 9600,"N",1,8,"N")
initOctalUARTPort("UART-0-2","octalUart0",2, 9600,"N",1,8,"N")
initOctalUARTPort("UART-0-3","octalUart0",3, 9600,"N",1,8,"N")
initOctalUARTPort("UART-0-4","octalUart0",4, 9600,"N",1,8,"N")
initOctalUARTPort("UART-0-5","octalUart0",5, 9600,"N",1,8,"N")
initSerialServer("FLAG1","UART-0-0",1000,20,"",0)
initSerialServer("FLAG2","UART-0-1",1000,20,"",0)
initSerialServer("FLAG3","UART-0-2",1000,20,"",0)
initSerialServer("FLAG4","UART-0-3",1000,20,"",0)
initSerialServer("FLAG5","UART-0-4",1000,20,"",0)
initSerialServer("FLAG6","UART-0-5",1000,20,"",0)
```